

### REMARKS

This application has been reviewed in light of the Office Action dated May 20, 2004. Claims 1-29 and 31-37, 41, 43, and 57-61 are presented for examination. Claims 1, 5, 6, 7, 10, 11, 13, 16, 17, 18, 19, 29, 31, 32, and 33, have been amended to define still more clearly what Applicants regard as their invention, and Claims 21, 22, 35, 36, and 43 have been amended to alter their dependency. Claims 57-61 have been added to provide Applicants with a more complete scope of protection. Claims 1, 13, 16, 29, and 57 are in independent form. Claims 38, 39, 40, 42, and 44-56 have been canceled without prejudice or disclaimer of subject matter. Accordingly, those claims will not be further discussed herein. Favorable reconsideration is requested.

Claims 3 and 28 were objected to for depending on a rejected claim. The Office Action states that those claims would be allowed if rewritten in independent form, with no change in scope. The Examiner is thanked for that indication.

Claims 16, 20, 21, 29, 34, and 35 were rejected under 35 U.S.C. 102(b) as being anticipated by JP8-115652 (Fumio et al.). Claims 17-19 and 31-31 were rejected under 35 U.S.C. 103(a) as being obvious over Fumio et al.

As amended, independent Claim 16 is directed to an electron-emitting device comprising (A) a first electrode and a second electrode placed in opposition to each other, with a gap between the first and second electrodes, on a surface of a substrate, and (B) a plurality of fibers electrically connected to the first electrode and comprising carbon. The fibers are placed on a surface of the first electrode facing the second electrode, so that

the fibers do not connect the first electrode to the second electrode.

Referring to page 2 of the Office Action, the Office Action sets forth the following comments in response to the Section 102(b) rejection of Claim 16:

“Regarding claim 16, Fig. 1b of the Fumio et al. reference discloses an electron emitting device comprising a first electrode (2) and a second electrode (2') formed in opposition to each other with a gap between them on a substrate (1). A plurality of fibers (3) are electrically connected to the first electrode and comprise carbon (paragraph 0008). As shown in Fig. 1b the fibers (3) are on a surface of the first electrode (2) facing the second electrode (2').”

Applicants respectfully disagree with the foregoing characterization, and submit that Fumio et al. does not disclose or suggest that fibers are disposed *on* a surface of a first electrode facing a second electrode. According to Fumio et al., as shown in Fig. 2D, a fiber 3 is disposed between electrodes 2 and 2' on a substrate 1. The fiber 3 extends from a surface of the substrate 1 towards a direction extending away from the substrate 1. This also can be understood in view of paragraphs (0021), (0099), (0103) and (0116) of the English translation of Fumio et al., of record. Accordingly, Applicants respectfully submit that the Office Action's assertion that Fumio et al. discloses that the fibers (3) are on a surface of a first electrode 2 facing the second electrode (2'), is incorrect.

Indeed, nothing in Fumio et al. would teach or suggest a plurality of fibers placed on a surface of a first electrode facing a second electrode, as recited in Claim 16. For these reasons, Claim 16 is believed to be clearly patentable over Fumio et al..

Independent Claim 29 recites features that are similar in many relevant respects to those of Claim 16 emphasized above, and also is believed clearly patentable

over Fumio et al. for substantially the same reasons.

Claims 1, 2, 4-27, 31-37, 41, and 43 have been rejected under 35 U.S.C. 103(a) as being obvious over U.S. Patent 5,610,471 (Bandy) in view of JP11-194134 (Den et al.). The Office Action does not specifically state that Claim 29 is rejected over those references, although page 8 of the Office Action addresses the claim in their context.

The recitations of Claim 16 are set forth above. Claim 29 recites features that are similar in many relevant respects to those of Claim 29.

Independent Claim 1, as amended, is directed to an electron-emitting device comprising (A) first and second electrodes disposed on an electrically-insulating substrate, wherein a gap is formed between the first and second electrodes, (B) a first layer formed on the first electrode and having an oxide of Ti, an oxide of Zr, or an oxide of Nb on a surface thereof, and (C) a fibrous carbon grown through a catalyst particle disposed on a sidewall surface of the first layer facing a side of the second electrode, so that the fibrous carbon does not connect the first electrode to the second electrode.

Independent Claim 13 recites features that are similar in many relevant respects to those of Claim 1.

For the following reasons, Applicants respectfully submit that the Office Action has failed to set forth a legally sufficient *prima facie* case of obviousness against Claim 1, 13, 16 and 29.

M.P.E.P. § 2143 sets forth the definition of a *prima facie* case of obviousness as follows:

To establish a *prima facie* case of obviousness, . . . there must be[, *inter alia*,] some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings[, and] there must be a reasonable expectation of success. The teaching or suggestion to make the claimed combination and the reasonable expectation of success must be found in the prior art, not in applicant's disclosure.

M.P.E.P. § 2143. (citation omitted).

It is fundamental that to establish *prima facie* obviousness the Examiner bears the burden of providing factual support for some suggestion or motivation to modify or combine cited references.<sup>1</sup>

The initial burden is on the examiner to provide some suggestion of the desirability of doing what the inventor has done. "To support the conclusion that the claimed invention is directed to obvious subject matter, either the references must expressly or impliedly suggest the claimed invention or the examiner must present a convincing line of reasoning as to why the artisan would have found the claimed invention to have been obvious in light of the teachings of the references."

M.P.E.P. § 2142 (quoting *Ex parte Clapp*, 227 USPQ 972, 973 (Bd. Pat. App. & Inter. 1985). Moreover, the Federal Circuit has recently emphasized that "a showing of a suggestion, teaching, or motivation to combine prior art references is an 'essential component of an obviousness holding'" *In re Sang Su Lee*, 277 F.3d 1338, 61 USPQ2d 1430 (Fed. Cir. 2002). This showing must be specific: "particular findings must be made as to the reason the skilled artisan, with no knowledge of the claimed invention, would

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<sup>1/</sup> "The examiner bears the initial burden of factually supporting any *prima facie* conclusion of obviousness." M.P.E.P. § 2142.

have selected these components for combination in the manner claimed.” *Id.* (citation omitted).

In support of the above Section 103(a) rejection, page 5 of the Office Action states:

“The use of carbon nanotubes as emitters in field emission devices is well known in the art. Carbon nanotubes are excellent emitters because of their small emitting areas and increased electron emission efficiency. Fig.8b of the Den reference teaches a method of growing carbon nanotubes parallel to a substrate.

Accordingly, one of ordinary skilled in the art, at the time the invention was made, would have found it obvious to use the method, taught by Den, of growing carbon nanotubes parallel to a substrate on which they are formed replacing the edge emitters of the first electrode (103) taught by the Bandy reference, in order to increase the electron emission efficiency of the lateral FED. Nanotube emitters are also preferred to edge emitters because they have the same diameter throughout their length, so that if the ends of the emitters is damaged or broken off, the emitter site will be the same size as before, and the electron emission efficiency of the emitters will be unaffected. If the tips of the edge emitters taught by Bandy are broken, the emitter site will increase resulting in a device having a poor electron-emitting efficiency.”<sup>2</sup>

Applicants respectfully disagree with the foregoing characterization.

First, Bandy discloses at lines 38-61 of column 2 an electron-emitting device that apparently emits an electron from an edge of a thin film emitter 103 (Figs. 1b and 2). That device of Fig. 1b is described as being “newer” and more advantageous than cone-shaped devices shown in, e.g., Fig. 1a. For example, lines 42-45 of column 2 describe that

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<sup>2/</sup>, Den et al. is a Japanese counterpart of publication EP 0 913 508 A2 cited in the Information Disclosure Statement filed December 6, 2001. The Office Action refers to a device disclosed in Figs.8 (b) of Den et al. According to Applicants’ understanding, Figs.8 (a) and (b) of Den et al. are used in an explanation of an electronic device according to an embodiment 5.

“It [i.e., the Bandy publication identified at col. 2, lines 38-40] sets forth the properties and advantages of thin film emitters in comparison with traditional cone-shaped emitters. These two structures for emission devices are shown in FIGS. 1a [cone-shaped device] and 1b [edge emitter device] of the instant patent application.”

The Office Action asserts that “[t]he use of carbon nanotubes as emitters in field emission devices is well known in the art[, and c]arbon nanotubes are excellent emitters because of their small emitting areas and increased electron emission efficiency”. However, the Office Action supplies no evidence whatsoever comparing the electron-emitting performance of the “newer” edge emitter in Figs. 1b and 2 of Bandy et al., with the electron-emitting performance of the emitter comprising a carbon nanotube. Neither does the Office Action provide any sufficient support that carbon nanotube emitters possess “small emitting areas and increased electron emission efficiency” as compared to edge emitters such as are shown in Figs. 1b and 2 of Bandy et al.

Moreover, presumably the Office Action’s assertion that carbon nanotube emitters have “small emitting areas” is based on an apparent perception that such nanotubes have a smaller diameter than do cone shaped emitters (as shown in, e.g., Fig. 1a) of Bandy et al. However, this may not necessarily be true in at least some cases, nor is it necessarily true that carbon nanotubes necessarily always have a smaller diameter than do emitter electrodes of edge emitter devices. Indeed, in describing an edge emitter device in lines 25-28 of column 4, Bandy et al. states:

“Finally, on the buffer layer 301 is a single crystal thin film (approximately 1000 angstroms thick) of conducting material 302, preferably heavily doped gallium arsenide. Other materials and thicknesses may be used.”

Therefore, by analogy, a thickness of an emitter electrode 103 of the edge emitter shown in Figs. 1b and 2 of Bandy et al. apparently can be 100 nanometers. In comparison, the diameter of a carbon nanotube described in paragraph (0005) of EP 0 913 508 A2 (English counterpart of Den et al.) is “1 $\mu$ m [i.e., 1000 nanometer] or less”. Thus, a carbon nanotube can have a larger thickness than an emitter electrode of an edge emitter, such as emitter electrode 103 of Bandy et al.

For these reasons, it is respectfully urged that the Office Action has failed to provide sufficient factual evidence (let alone a sufficient basis for asserting ‘common knowledge’) which would support the conclusion that carbon nanotube emitters possess “small emitting areas and increased electron emission efficiency” as compared to an edge emitter device such as that shown in Figs. 1b and 2 of Bandy et al.<sup>3</sup> M.P.E.P. 2144.03 (“It is never appropriate to rely solely on ‘common knowledge’ in the art without evidentiary support in the record, as the principal evidence upon which a rejection was based” (citation omitted) . . . . “The examiner must provide specific factual findings predicated on sound technical and scientific reasoning to support his or her conclusion of common knowledge” (citations omitted)).

In view of the foregoing, it is respectfully submitted that the Office Action has failed to establish a sufficient motivation for substituting the carbon nanotube of Den et

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<sup>3/</sup> If the Examiner disagrees, he is respectfully requested to provide documentary evidence in support of the conclusion, or, if the Examiner is relying on his personal knowledge, he is respectfully requested to provide an affidavit or declaration setting forth specific factual statements and a supporting explanation, pursuant to M.P.E.P. 2144.04 (C).

al. in the edge emitter of the Bandy et al., as posited in the Office Action. Owing to the absence of such a motivation, and the failure of the Office Action to provide a sufficient factual basis and a convincing line of reasoning showing that such a motivation was recognized in the prior art, Applicants respectfully urge that the Office Action's proposed combination of Bandy et al. and Den et al. is based merely on impermissible hindsight reasoning, since it proposes to combine references to achieve a result apparently gleaned solely from Applicants' disclosure, simply to have a basis for rejecting the claims, without any sufficient teaching, suggestion, or motivation in the prior art to so combine those references. *Uniroyal, Inc. v. Rudkin-Wiley Corp.*, 837 F.2d 1044, 1051-52, 5 USPQ 2d 1434, 1438 (Fed. Cir. 1988) (it is impermissible to reconstruct the claimed invention from selected pieces of prior art absent some suggestion, teaching, or motivation in the prior art to do so); *In re Fritch*, 972 F.2d 1260, 23 USPQ 2d 1780 (Fed. Cir. 1992) ("[I]t is impermissible to use the claimed invention as an instruction manual or 'template' to piece together the teachings of the prior art so that the claimed invention is rendered obvious. . . . This court has previously stated that '[o]ne cannot use hindsight reconstruction to pick and choose among isolated disclosures in the prior art to deprecate the claimed invention.'").

For these reasons alone, it is submitted that Claim 1, 13, 16 and 29 are patentable over Bandy et al. and Den et al.

Applicants also believe that Claim 1, 13, 16, and 29 are patentable over those references for the following additional reasons.

The device shown in Figs. 8(a) and 8(h) of Den et al. is not an electron-



emitting device. The device shown in Figs. 8(a) and 8(h) is one wherein a member 22 (alumina film) of an electrode 81 side is connected to a member 87 (an insulating film) of an electrode 88 side. However, Den et al. Does not disclose or suggest any embodiments wherein the member 22 (alumina) of the electrode 81 side is not connected to the member 87 (the insulating film) of the electrode 88 side.

Accordingly, Den et al. neither discloses nor suggests stopping and incompleting growing the carbon nanotube so as not to connect the member 87 (insulating film) of the electrode 88 side to the member 22 (alumina film) of the electrode 81 side. Accordingly, even assuming *arguendo* that the edge emitter of Bandy et al. were to be replaced with the carbon nanotube produced as disclosed in Den et al., then in the resulting combination electrodes 106 and 104 (or 204) would be connected through the carbon nanotube. According to independent Claims 1, 13, 16 and 29, on the other hand, the first and second electrodes are not connected through the fibrous carbon (Claims 1 and 13) or fibers (Claims 16 and 29). Therefore, for these reasons as well, each of those independent claims is believed to be clearly patentable over those references, whether considered separately or in combination.

Added independent Claim 57 recites:

“57. An electron-emitting device comprising:

- (A) a first electrode and a second electrode disposed on a surface of a substrate, with a gap disposed between said first and second electrodes; and
- (B) a plurality of fibers electrically connected to a surface of said first electrode facing said second electrode,  
wherein a height from the surface of said substrate to said fibers is larger than a height from the surface of said substrate to a top surface of said second

electrode.” (Emphasis added).

It is respectfully submitted that nothing in Fumio et al., Bandy et al., and Den et al., would teach or suggest at least the above-underlined features of Claim 57, and therefore the claim is believed to be clearly patentable over those references.

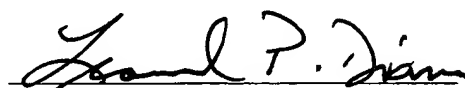
The other claims in this application are each dependent from one or another of the independent claims discussed above and are therefore believed patentable over the art relied on by the Examiner for the same reasons as are those independent claims. Since each dependent claim is also deemed to define an additional aspect of the invention, however, the individual consideration or reconsideration, as the case may be, of the patentability of each on its own merits is respectfully requested.

In view of the foregoing amendments and remarks, Applicants respectfully request favorable reconsideration and early passage to issue of the present application.

An Information Disclosure Statement was filed in the Patent and Trademark Office in this application on July 9, 2004. Consideration of that Information Disclosure Statement is respectfully requested, as is confirmation of such consideration.

Applicants' undersigned attorney may be reached in our New York office by telephone at (212) 218-2100. All correspondence should continue to be directed to our below listed address.

Respectfully submitted,

A handwritten signature in cursive script, reading "Leonard P. Diana", written over a horizontal line.

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